



712CD

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Air Force Materiel Command

War-Winning Capabilities ... On Time, On Cost



Multi-Echelon Modeling for Improved Supply Chain Performance

Selected Essential Item Stock for
Availability Method (SESAME) to
“right-size” DoD inventory

HQ AFMC/A8S

Mrs. Deb Hileman/Mr. Greg Gehret

11 Jun 07

DSN 787-4535

Unclassified Informational Brief

Integrity ~ Service ~ Excellence



Overview



- **Why DOD needs multi-echelon modeling**
- **Background on Air Force Inventory Efficiency**
- **What is Multi-echelon modeling**
- **Multi-Service Effort to Implement Multi-Echelon Modeling using SESAME**
- **Status of SESAME, Multi-Echelon Model, Pilot at Ogden Air Logistics Center**
- **Summary**



Why DOD needs multi-echelon modeling



Pick one

BRAC expands DLA's role

"...fosters collaborative approach..."²

Right-sizing DoD Inventory

"multi-echelon techniques are valuable and can lead to large improvements in cost and service"¹

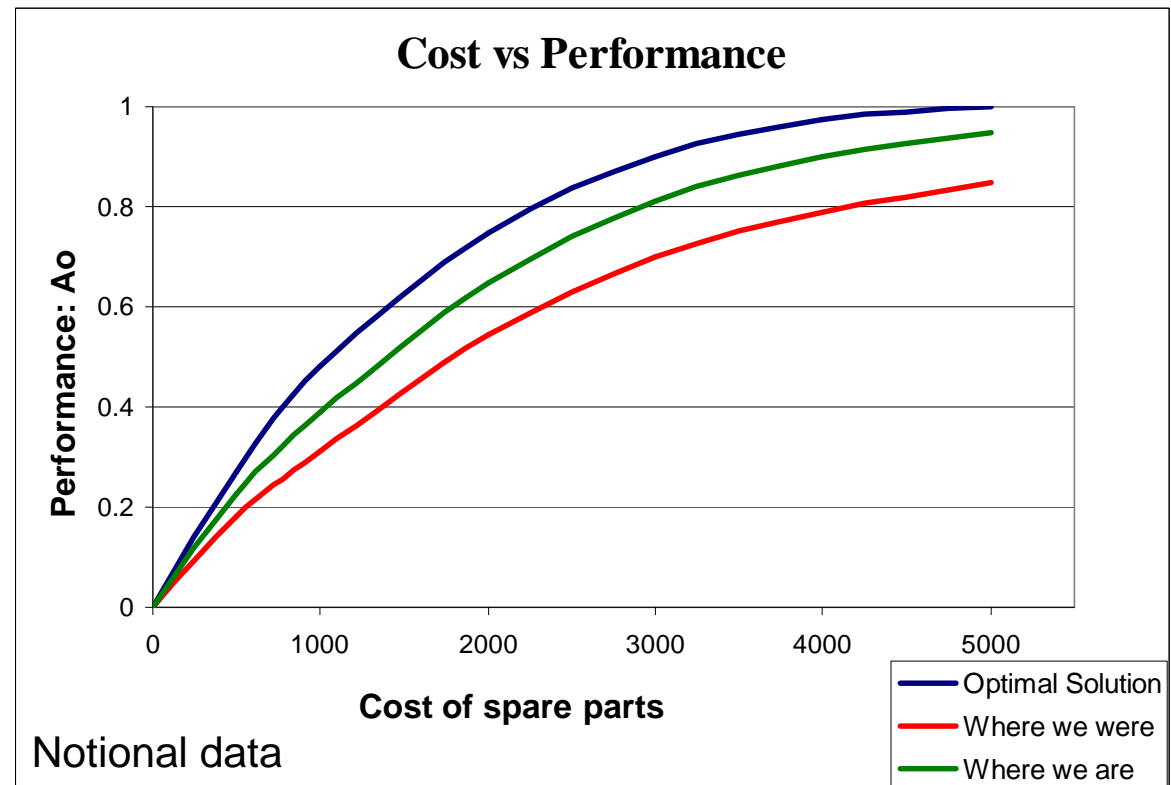
- **Enterprise view of supply chain optimizes inventory levels system-wide**
 - The right level of the right part at the right location
 - Money, Money, Money...

- 1. Silver, Pike, Peterson, "Inventory Management and Production Planning and Scheduling"
- 2. CACIs (working with MCA's SPO) website: "Readiness-based Sparing – Benefits"



Multi-Echelon Models

What do they do?



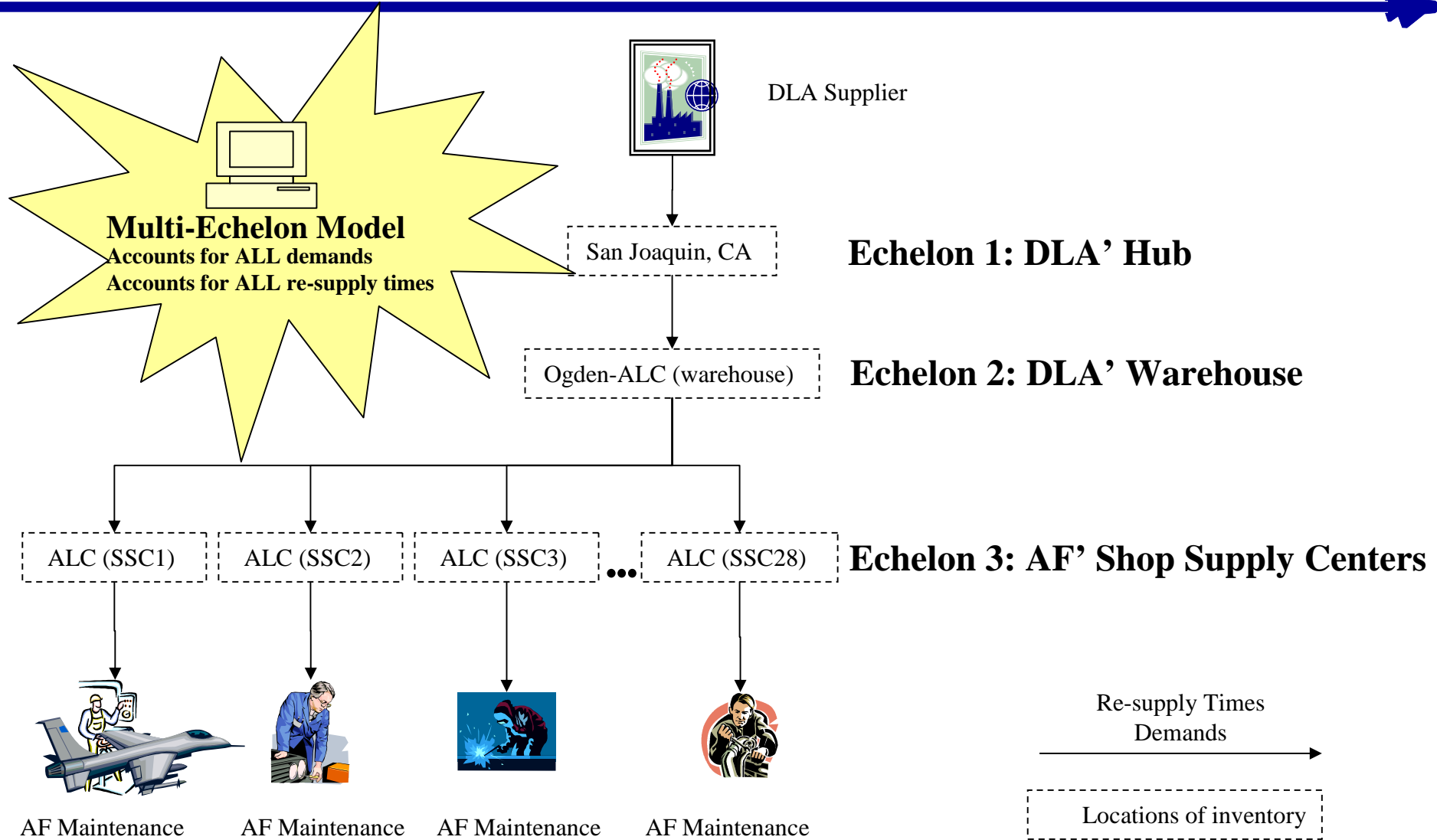
Historical perspective:

- Where we were: Pre COLT, very little mass AF/DLA collaboration
- Where we are: With COLT (single echelon), AF and DLA data collectively yields better performance for the same Cost
- **Where we need to be: Multi-echelon models will further improve performance bringing it closer to the mathematically optimal solution**



Why Multi-Echelon Models

What do they look like?





Background on Air Force Inventory Efficiency (AFIE) Pilot



- **AFIE, response to PBD 422, focused on bullet 2:**
“Directs Army, Navy, Air Force, and DLA to plan to eliminate retail operations...”
- **AFIE pilot began at OC-ALC Jun 03; \approx 3K NIINs**
- **AFIE pilot began at OO-ALC Aug 04; \approx 2.5K NIINs**
- **AFIE had two goals:**
 - **Reduce AF “duplicative” stock (save inventory \$)**
 - **Maintain warfighter support (no degradation to support)**



Background (cont'd)



How is support for Consumable Items measured?

Customer Wait Time

- **CWT relates how long maintenance has to wait for part**
 - **Affects scheduling and resource allocation at the ALCs**
 - **Affects timing of LRUs/SRUs repair for ALCs and bases**
 - **Affects PDM line (shop flow) at the ALCs**
 - **Affects MICAP Hours at the bases**



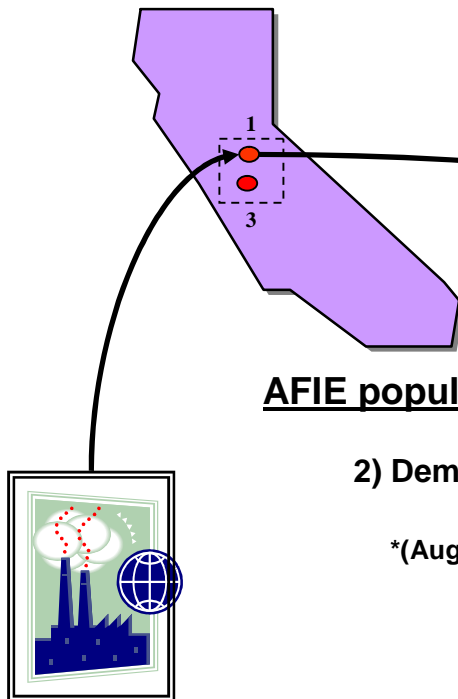
Background (cont'd)

Current AFIE Level Setting Process



San Joaquin, CA

- ¹ DLA-owned (SDP “hub”)

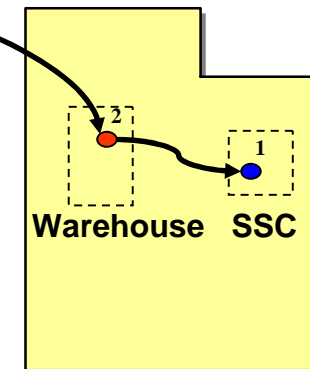


DLA Supplier

Ogden ALC, UT

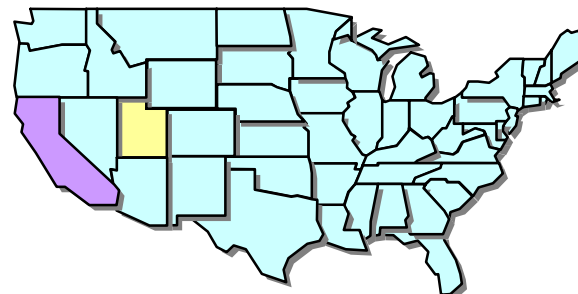
- ² DLA-owned (warehouse)
- ¹ AF-owned (SSC, forward located)
- ³ DLA-owned (hub or spoke??)

- AF computed/DLA applies business rules an may/may not increase safety stock



AFIE population at OO-ALC as of May 07:

- 1) 2,350 NIINs
 - 2) Demands: 635 units of demand/day
 - 3) Dollars: \$99,935 / day
- *(Aug 05: DDR=760 and Daily Cost=\$102K)



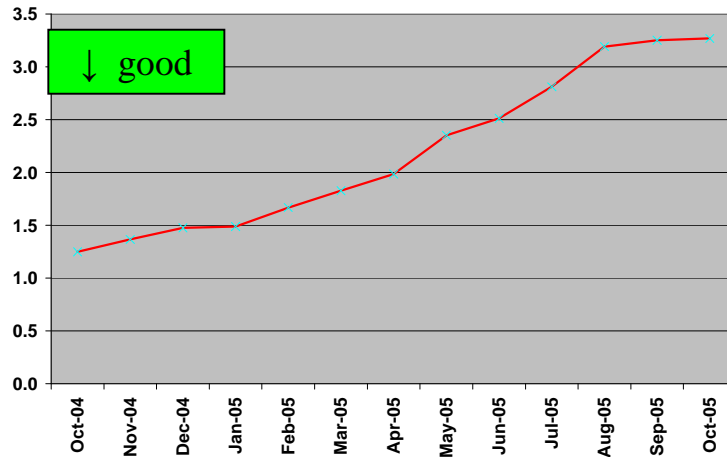
(OO-ALC and “upstream”)



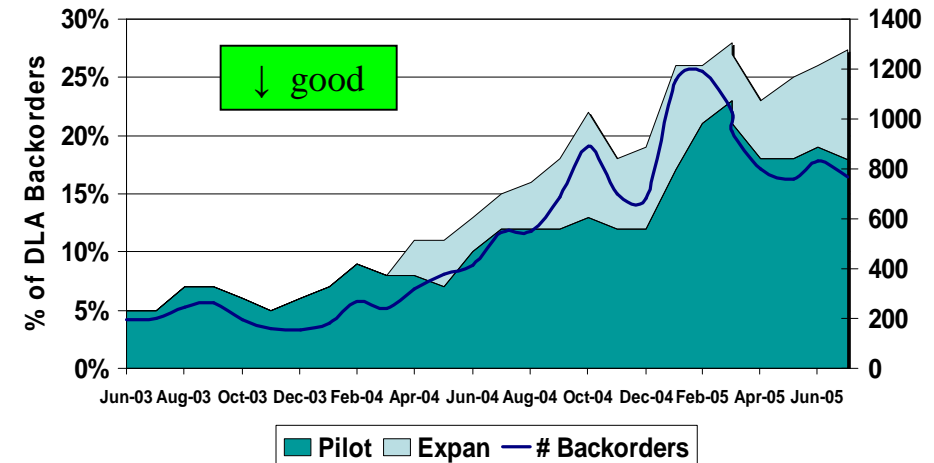
Background (cont'd)

Where We Are ... AFIE – Support

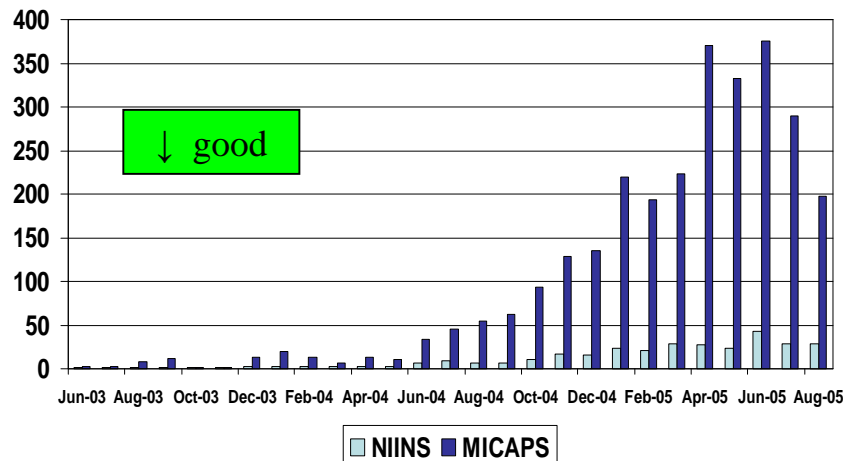
Customer Wait Time: AFMC Command



Backorders: OC-ALC



MICAPS: OC-ALC



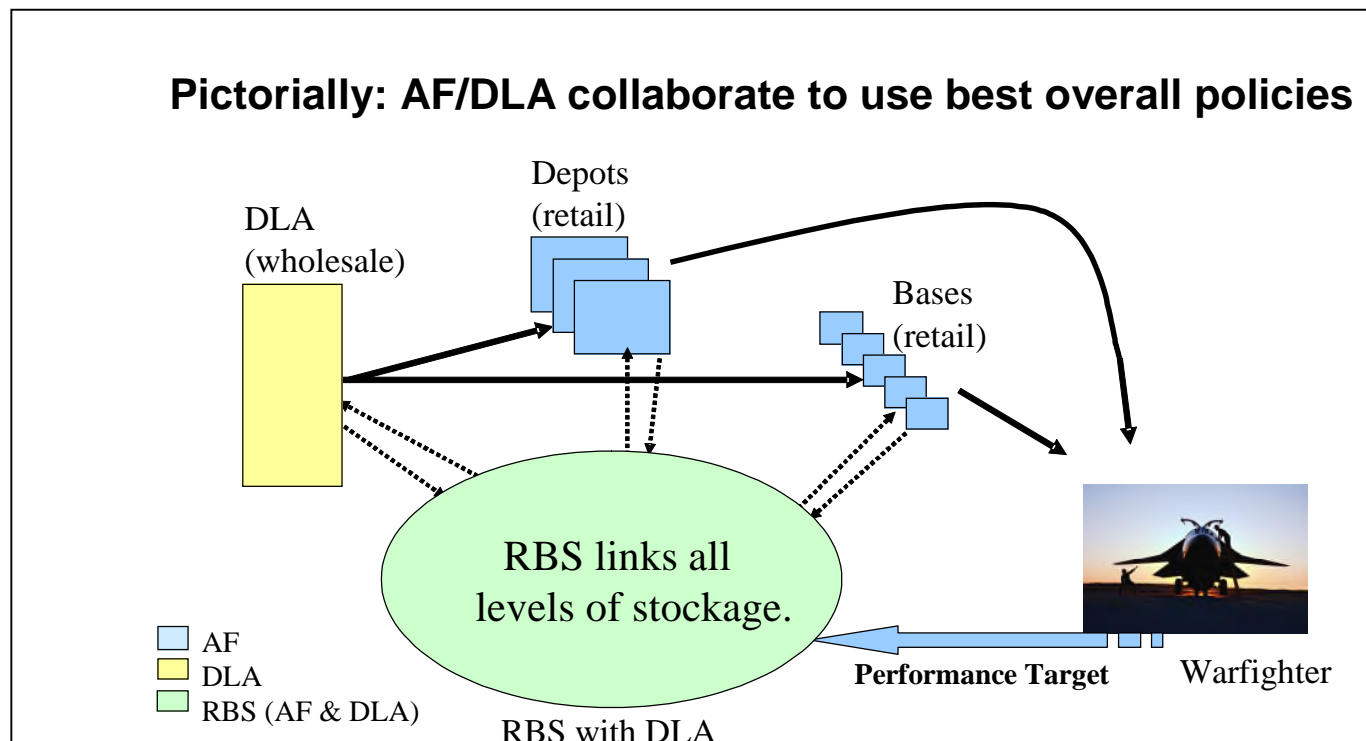
Background Summary:

- AFIE may have reduced inventory; however, at a substantial degradation to warfighter support
- AFIE current business rules are not RBS
- AF/DLA working to inject RBS into AFIE
- This pilot offers a unique opportunity for DoD to 'lean forward' on BRAC recommendations



How can we “fix” AFIE?

Create a joint AF/DLA process that would link DLA inventory investments with AF support



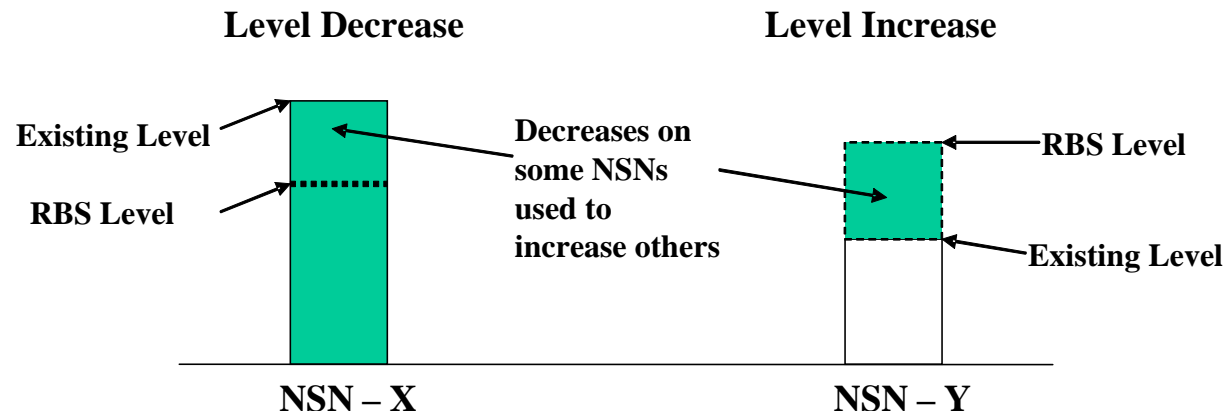
Adding RBS to AFIE meets the full intention of PBD 422



How can we “fix” AFIE (cont’d) Execution



- RBS model will set a better mix (breadth and depth) of “consumable” levels
 - Lack of part means waiting DLA procurement Lead Time
- Near immediate impact to maintenance:
 - LRUs/SRUs repaired in timely fashion



Reduced LRU repair time = increased Ao



How can we “fix” AFIE (cont’d)



CWT on Consumable Items Affects Many Weapon Systems

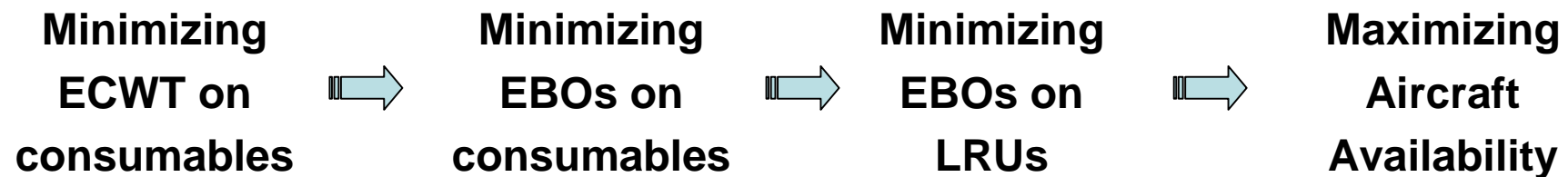


- EBOs on Line Replaceable Units (LRUs) are the basis for calculating Aircraft Availability (Ao)
- The relationship between Ao and EBOs:

$$\text{EBOs/Number of Aircraft} \approx -\ln(\text{Ao})$$

CWT is related to EBOs:

$$\text{ECWT (in days)} = \text{EBOs/Daily Demand Rate}$$



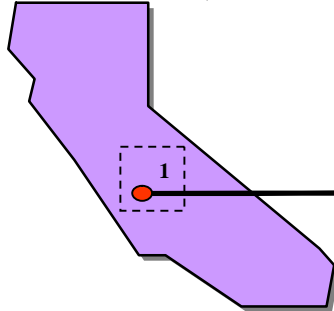


Inventory Systems...future supply chain what would SESAME do?



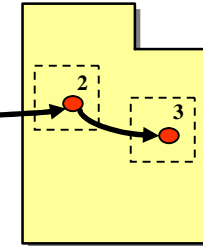
San Joaquin, CA

- ¹ DLA-owned (SDP “hub”)



Ogden ALC, UT

- ² DLA-owned (warehouse)
- ³ DLA-owned (forward located)



● Locations of inventory

★ Inventory Tools/Models

★ **SESAME (IPT)**

- ¹ $\text{Level}_1 = \text{EOQ}_1' + \text{ROP}_1$
- ² $\text{Level}_2 = \text{EOQ}_2' + \text{ROP}_2$
- ³ $\text{Level}_3 = \text{EOQ}_3' + \text{ROP}_3$

***Level₁, *Level₂, and Level₃: determined by SESAME (via marginal analysis trade-offs)**

**EOQ₁, EOQ₂, and EOQ₃: determined by SESAME

ROP₁, ROP₂, and ROP₃: determined by SESAME

**Simultaneously determines the right levels at the right locations
to achieve the targeted ECWT at the least DoD cost**

* another option in SESAME is to use Expected Fill Rate in lieu of Level

** EOQ1 can be either an input to SESAME or computed by SESAME (as Wilson EOQ)



SESAME Purpose



SESAME is a **Multi-Echelon, Multi-Indenture** Inventory Model that determines the **Optimal** Range and Depth of Spares and Repair parts at all locations in order to meet either a Weapon System/End Item **Budget Constraint** or **Operational Performance Target**

Any
group
of
items

CWT
for
Pilot



SESAME

Objective Function



Find **Least Cost** set of spares by location, which achieves backorder/CWT target

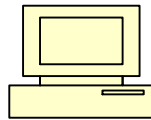
Tradeoff, over all items at all locations, **Backorder/CWT Reduction** at User Echelon for **increased stock cost**



Data needed for SESAME Pilot general flow diagram



SESAME

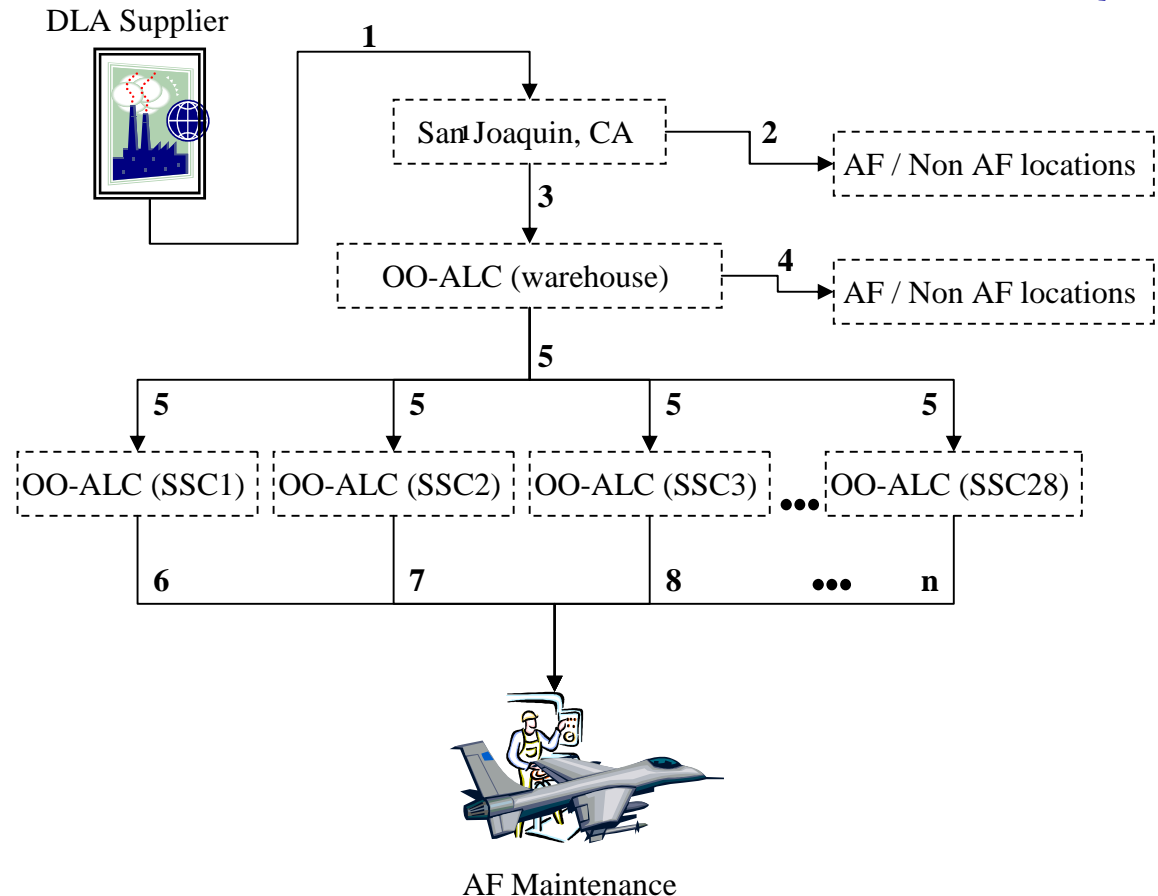


Already known factors:

- NSNs
- Unit Price
- Cube (dimensions of part)
 - May need default value ???
- Target Logistics Delay Time (i.e. CWT goal)

Factors still to get:

- Demand Rate (for each location)
 - DLA: 2, 3, 4
 - AF: 5, 6, 7, 8, ... , n
- OST between each location (for all the arrows)
 - DLA: 1, 2, 3, 4
 - AF: 5

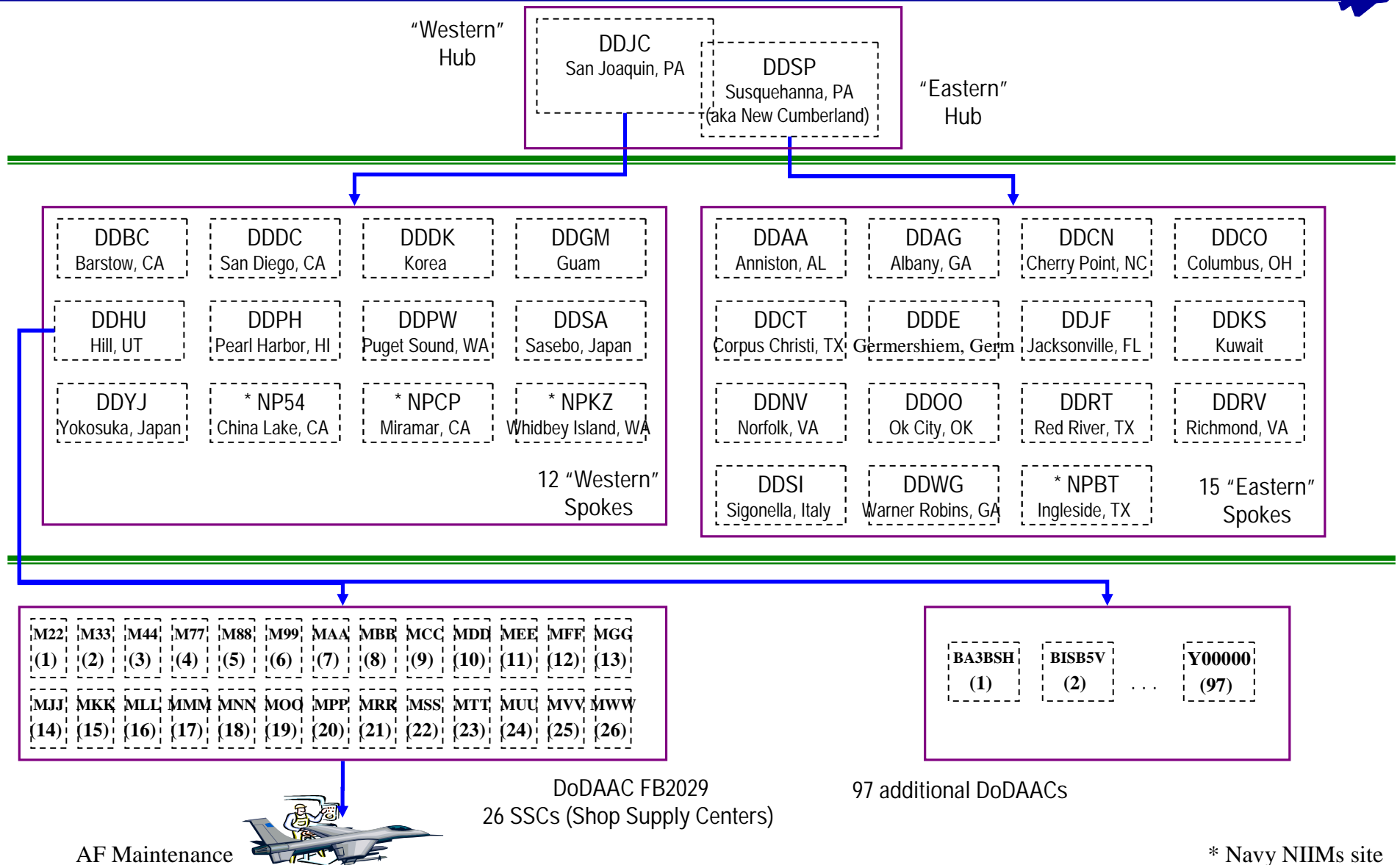


Order and Ship Time (OST) →

Locations of inventory



Using SESAME on Ogden's AFIE items





Multi-Service Effort to Implement Multi-Echelon Modeling



- **DLA recognized a gap in the Wholesale tool-set for Retail management and stood up a multi-service IPT to investigate implementing Multi-Echelon Modeling**
- **The Multi-Service IPT supports a plan to fill the gap in the DLA tool-set by using an existing Service (Army) model while DLA works the long-term Inventory Policy Optimization (IPO) implementation in BSM**
- **The use of a proven RBS tool, Selected Essential Item Stock for Availability Method (SESAME) was accepted by the IPT**
- **The IPT recommended use of SESAME to determine AF/DLA levels for OO-ALC AFIE items (2530 Items)**



Status of SESAME implementation



- **Analysis completion expected end of Jun 07**
- **Implementation Alternatives/Issues Determination**
- **Brief AF and DLA to obtain implementation approval with discussions on metrics**
 - **Already have GO support for the initiative**
 - **Tools exist within BSM to change levels settings**
- **Further expansion across USAF remains TBD**



SUMMARY



- **Timeline for DLA to have multi-echelon modeling capability still unknown**
 - Limited Service budgets won't allow us to wait
- **In the interim use SESAME**
 - Proven multi-echelon Army model
 - No new development, can use “off-the-shelf”
- **Potential to generate BRAC savings**
- **Implementing near-term is “Do-able” based on out pilot results**

Improve warfighter support without increasing costs

